MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 2, 2022/2023

BER2094 – ENVIRONMENTAL & RESOURCES ECONOMICS

(All Sections/Groups)

14 July 2023
9.00 am – 11.00 am
(2 Hours)

INSTRUCTIONS TO STUDENTS

1. This Final Exam consists of **EIGHT (8)** pages including a cover page with Section A and Section B.
2. Section A consists of **TWO (2)** Case Studies. Section B consists of **TWO (2)** Structured Questions.
3. Please **write the answers in the answer booklet** provided.
4. Candidates **MUST** attempt **ALL** questions.
5. The marks distribution for each question is given. Total marks 100.

SECTION A: CASE STUDIES

CASE STUDY 1 (40 marks):

The bottom-up approach to tackling river pollution

GEORGE TOWN: An expert has proposed a bottom-up instead of the top-down approach to tackle pollution plaguing Penang's rivers.

Professor Dr. Nor Azazi Zakaria, who is Universiti Sains Malaysia (USM) engineering campus river and urban drainage research center director, said people must be empowered to run campaigns like the One State One River plan and feel like they "own" the river. "There must be a public-private Love Our Rivers Campaign partnership with input and contributions from government departments, private consulting or advertising companies, non-governmental organizations (NGO), and communities. "There should be a bottom-up approach rather than a top-down approach. "Government departments should not be allowed to run it as they do not have the expertise in public awareness, public education, or environmental education. "I believe that through this approach (of roping in people), only then can we see results," he told the *New Straits Times*. He was commenting on the NST report on the pollution level of Penang's rivers.

Of the seven main rivers in the state, six of them are in Class III based on the river basin water quality index (WQI) 2016-2022 readings. It was also reported that 26 of 33 river tributaries that flow into the seven main rivers in the state were slightly polluted and polluted, based on the WQI. According to the Penang River Quality 2021 (interim) data released by the state Department of Environment (DoE), 21 of the river tributaries are slightly polluted, five are polluted, and seven are clean.

AWARENESS CAMPAIGNS

Nor Azazi said the Love Our Rivers Campaign was first launched by the Department of Irrigation and Drainage (DID) in 1993 to educate the public on the importance of rivers and the environment and highlight the critical state of pollution faced by rivers. He said the DID had its One State, One River plan, launched in 2002. The programme requires each state to select, with the agreement of the state government, one polluted river for rehabilitation. The rehabilitation is to be carried out over 10 or 15 years with short-term programmes as follows:

FRAMEWORK for rehabilitation programmes for upstream, middle, and downstream stretches of rivers;
RUBBISH removal with the installation of a rubbish trap at the source;
FULL enforcement of Manual Saliran Mesra Alam by authorities for all new developments or redevelopments;

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ENFORCEMENT of treatment systems, such as food, oil and grease, and gross pollutant trap, by authorities for food stalls, markets, and other activities that contribute to river pollution;
RESETTLEMENT of squatters and relocation of other activities besides river that cause pollution;
RIVERS and their reserves to be gazetted and used as a riparian zone for different habitats depending on the river usage, such as urban, rural, and water catchments:
PROMOTE and encourage the private sector to follow best management practices for all types of developments, such as erosion and sediment control plan;
TO tighten approval and enforcement of sand mining rules together with mandatory requirements for silt screen to control suspended sediment materials; and,
THE main implementation strategies are preventive measures, curative measures, and management, and a few committees involving all stakeholders have been formed to achieve the vision of clean rivers.

LACK OF COORDINATION

Nor Azazi, who is also the Unesco chair on Eco hydraulics for Sustainable Water Infrastructures for Sustainable Development Goal 6 in Asia and the Pacific region, said the lack of coordination between government agencies was one of the reasons the majority of Penang's rivers remained in Class III. "There are uncertainties in prescriptive and enforcement jurisdiction since river pollution often arises from various sources of pollution. "So public awareness is crucial to (improve) river water quality. "Sustainable management of rivers needs the support and collaboration among the government, public, and stakeholders (such as industrialists, farmers, educational system)," he added.

Nor Azizi said the pollution in Sungai Pinang, widely acknowledged to be the state's worst-polluted river, was caused by water from human settlements and slaughterhouses, industrial waste, wet markets, and agriculture. As for Sungai Juru, the pollution was caused by livestock farms and sewage; for Sungai Jawi, the major pollutants were sewage, livestock farm, and industrial areas. He said states might not effectively deal with environmental problems due to the limitation of resources for manpower, budget, monitoring equipment, and technical expertise. He added that efforts from DoE, DID, NGOs, and the public were expected to tackle the issue. "There is no point in cleaning rivers if drains continue to be dirty. "River pollution should be tackled upstream to which drains are connected. "There has to be a mechanism for the state's drains to prevent rubbish and other pollutants from entering the rivers. Drain water needs to be cleaned before it enters rivers. A clean drain means clean rivers. "A sustainable urban stormwater management system should be put in place, depending on the suitability of the area."

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IRBM

Nor Azazi said the Integrated River Basin Management (IRBM) action plan had been implemented and completed for Sungai Juru and Sungai Prai last year. IRBM involves 10 aspects: prevention of contamination by livestock waste; establishment of individual treatment plants; centralised wastewater treatment plant; increasing river environmental awareness; an incentive to farmers for improvement of waste management; improving solid waste management system in the river basin; installation of gross pollutant/garbage trap: improving enforcement; ensuring better management of sullage; and sanitation system and real-time effluent monitoring programme for factories.

On the prevention of contamination by livestock waste, he said livestock waste, after treatment, could be disposed of in accordance with regulations without endangering the environment. He said livestock waste treatment plants should be designed, constructed, operated, and maintained to not pollute the environment. On the establishment of treatment plants, he said their establishment was proposed in livestock farms within the basin to control waste discharge into river systems. On the centralized wastewater treatment plant, he said it could be established if farms could be relocated to a zone where the treatment could be integrated into a single plant. With a centralized livestock farming, wastewater would be treated and monitored more efficiently. "The success of this system can happen only with cooperation from all parties.

"Firstly, the government should advise on legislation requirements, and facilitate a soft loan to farmers. "Secondly, farmers should be willing to invest in the service. Thirdly, farmers should be aware of their responsibility to preserve the environment. "For example, improve or upgrade the regional sewage treatment plant in Kota Permai to serve the Juru population and enable water quality compliance to class II (IRBM Sungai Juru). "It is vital that the overloaded Regional Sewage Treatment Plant (STP) in Kota Permai is upgraded to maintain or improve its efficiency levels in treating sewage. "Other STPs that are malfunctioning should be shut down, repaired, or upgraded to maintain or improve their efficiency levels in treating sewage. "All STPs should comply with the Class II standard of effluent. This can be achieved by extending and upgrading the treatment process."

Source: By Audrey Dermawan - May 31, 2022, @ 9:05 am, New Straits Times
https://www.nst.com.my/news/nation/2022/05/800933/bottom-approach-tackle-river-pollution

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Based on the above article, answer the following questions:

a) Demonstrate why the bottom-up approach is better than the top-down approach in tackling river pollution. (10 marks)

b) Illustrate any **TWO (2)** major threats to Penang's rivers' pollution. (6 marks)

c) Show the **SIX (6)** main parameters used to calculate Malaysia's Water Quality Index (WQI). (6 marks)

d) Based on the article, present any **TWO (2)** actions proposed by Professor Dr. Nor Azazi Zakaria to be strictly implemented by the government to tackle river pollution. (8 marks)

e) Illustrate a suitable market-based approach for the government to reduce water pollution in Penang. (10 marks)

CASE STUDY 2 (40 marks):

Gearing up for energy efficiency

Energy-efficient measures can reduce power bills by as much as 25% SOME of the earliest shophouses in Melaka were built in the late 18th century. The traditional shop lots used to house businesses on the ground floor while the family lived on the upper floor. The architects of old constructed the buildings in such a way that they not only offered protection from rain but could cope with the humid weather and scorching tropical heat. Long before recycling and renewable energy became trendy, olden-day builders already knew how to make the most out of natural resources, conserve energy and be more fuel-efficient. The ceilings were extra high, not only to give the perception of spaciousness but to let in more natural light and ventilation. Air wells were introduced to brighten and cool the interior and were an avenue for the heat to dissipate. Combed doors and louvered windows provided natural ventilation, while terracotta tiles on lime concrete bare floors allowed the ground moisture to rise and cool the room.

Fast forward to the 21st century when urbanization is progressing at a rapid pace and smart cities are looked upon as a solution for better use of resources and a more sustainable environment; architects today might well take a page from the past.

Building sustainable smart cities

The United Nations predicts that two-thirds of the world population will be living in cities by 2050 – which means there will be a huge strain on resources and higher consumption of energy. It makes sense then to develop a smart city vision and focus on more energy-efficient and sustainable buildings, especially considering how the building sector accounts

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for about 40% of primary energy usage. In the long run, green buildings are projected to give better economic savings in terms of energy, maintenance, and operational cost savings. Energy-efficient buildings follow a bioclimatic architectural approach in which the shape, direction, and in-built functions all work synergistically to improve energy consumption and maximize the building's energy performance. Employing smart energy-efficient measures and renewable energy as a source of power, energy bills can be reduced as much as 25%. Smart city solutions are also about intelligent town planning and management and improving connectivity and quality of life for the residents. This means incorporating sustainable infrastructure, environmental conservation, and waste management to combat climate change and air pollution.

What is energy efficiency?

Efficient use of energy means using less energy to power the same equipment or services and eliminating energy waste. While it may seem like the same thing, there is a difference between energy conservation and energy efficiency. Conserving energy is more about adopting behaviour that results in using less energy such as choosing to use the stairs instead of the elevator or switching off lights that are not in use. We use energy for cooking, heating and cooling rooms, manufacturing, lighting, transportation, and a host of other applications. By making a conscious choice to use more energy-efficient products and processes, energy costs are lowered, reliance on energy imports is lessened and greenhouse gas emissions are reduced. For example, a 12-watt LED bulb can produce the same amount of light as a 60-watt regular bulb but uses 75-80% less energy. At home, small steps such as using LED light bulbs, energy-efficient cooling and heating systems, energy-efficient appliances, and installing solar panels go a long way in lowering utility expenses. On a larger scale, manufacturing facilities consume the most energy so it is imperative to evaluate energy usage to determine how the consumption can be reduced. Lighting, machinery and equipment, and air-conditioning are often the main energy guzzlers. To enhance energy efficiency and sustainability measures, smart grid technologies can help to improve operations, maintenance, and power supply.

Apart from constructing new green buildings, retrofitting existing buildings is another way to bring energy costs down. Repurposing buildings is a sustainable way to give older developments a new lease of life – thanks to energy-saving solutions such as maximizing natural lighting and adding green spaces, installing rooftop photovoltaic solar panels for renewable energy, smart thermostats, energy-efficient window glazing, and ventilation louvers.

Leading green countries

Generally, buildings and construction projects have been identified as key contributors to global carbon dioxide (CO2) emissions, accounting for 39% of total emissions. As such, government agencies and the private sector are paying more attention to green initiatives and making concerted efforts to draw up sustainability policies. Under the Paris Agreement

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2015, Asian countries have pledged to reduce emission intensity by up to 65% by 2030. As one of the signatories, Malaysia has pledged to reduce greenhouse gas emissions by 45% (based on 2005 emission intensity levels) by 2030.

Malaysia was a participant in the recent 26th United Nations Climate Change Conference of the Parties (COP 26), and as part of our commitment, we are focusing on sustainability as one of the key drivers under the 12th Malaysia Plan. As announced in the recent Budget 2022, a growing expenditure has been allocated for sustainability initiatives towards efforts to become a carbon-neutral nation by 2050. Malaysia has also activated the National Energy Efficiency Action Plan 2016-2025 to encourage the adoption of energy efficiency by reducing electricity demand growth by 8% over a 10-year period – resulting in a total reduction in CO2 emissions by 38 million tonnes. The Green Investment Tax Allowance for the purchase of green technology assets and Green Income Tax Exemption on the use of green technology services have also been extended until 2023.

In Asia, Singapore leads the charge as it has managed to green 43% of its buildings as of December 2020 an impressive effort towards the Building and Construction Authority (BCA)'s target of 80% by 2030. On top of BCA's push for higher energy performance, there has been a 14% improvement in energy efficiency recorded for commercial buildings compared to more than a decade ago. This translates to 1,000 gigawatt-hours in energy amounting to S$200mil (RM617mil) in savings per year. Among the top cities deemed energy-efficient and recognized globally for their efforts in reducing carbon footprint and conserving resources are Copenhagen (Denmark) and Vancouver (Canada). A third of Copenhagen's population commute on bicycles daily while widespread green roofs not only provide insulation for its residents but slow down the absorption of water into drains and sewers. The city also sources part of its renewable energy from a large offshore wind farm. Vancouver is on track to becoming the world's greenest city, having the lowest carbon emissions per capita in North America. It uses hydroelectric power as 90% of its energy source, not to mention the host of incentives for its residents who take up energy efficiency programs.

Unlike other loftier sustainability goals, energy efficiency is something that everyone can do as it is the easiest to achieve and the most effective. If homeowners, offices, and big industries all work together to bring about change, there is a realistic hope of a reduction in energy costs and the greenhouse effect.

Source: Monday, 13 Dec 2021
https://www.thestar.com.my/business/business-news/2021/12/13/towards-more-efficient-use-of-energy

Based on the above article, answer the following questions:

a) Illustrate why energy efficiency could combat climate change and air pollution.
(10 marks)

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b) Refer to the article, illustrating energy-efficient buildings and smart cities. Illustrate how could they lead Malaysia to become a green country. (10 marks)

c) With the aid of a diagram, present a suitable market-based instrument for Malaysia's government to support the development of green buildings. (12 marks)

d) *Singapore leads the charge as it has managed to green 43% of its buildings as of December 2020 – an impressive effort towards the Building and Construction Authority (BCA)'s target of 80% by 2030.*

Evidence any **TWO (2)** challenges that need to be overcome by Malaysia, especially in the process of retrofitting existing buildings. (8 marks)

SECTION B: STRUCTURED QUESTIONS (20 marks)

QUESTION 1 (10 marks)

Kuala Lumpur has long been plagued by urban smog. One of several ozone-reducing policy options is being evaluated by economists using benefit-cost analysis. Since the policy will be implemented over time, economists assume that per-resident benefits will accrue in increments of $250 (in real terms) at the end of each of the next three years. Compute the present value of benefits (PVB) in nominal terms for each resident, assuming an annual inflation rate of 2% and a nominal annual discount rate of 4.5%. (10 marks)

QUESTION 2 (10 marks)

Illustrate with a suitable diagram how the Environmental Kuznets Curve (EKC) finds the relationship between economic growth and pollution. (10 marks)

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